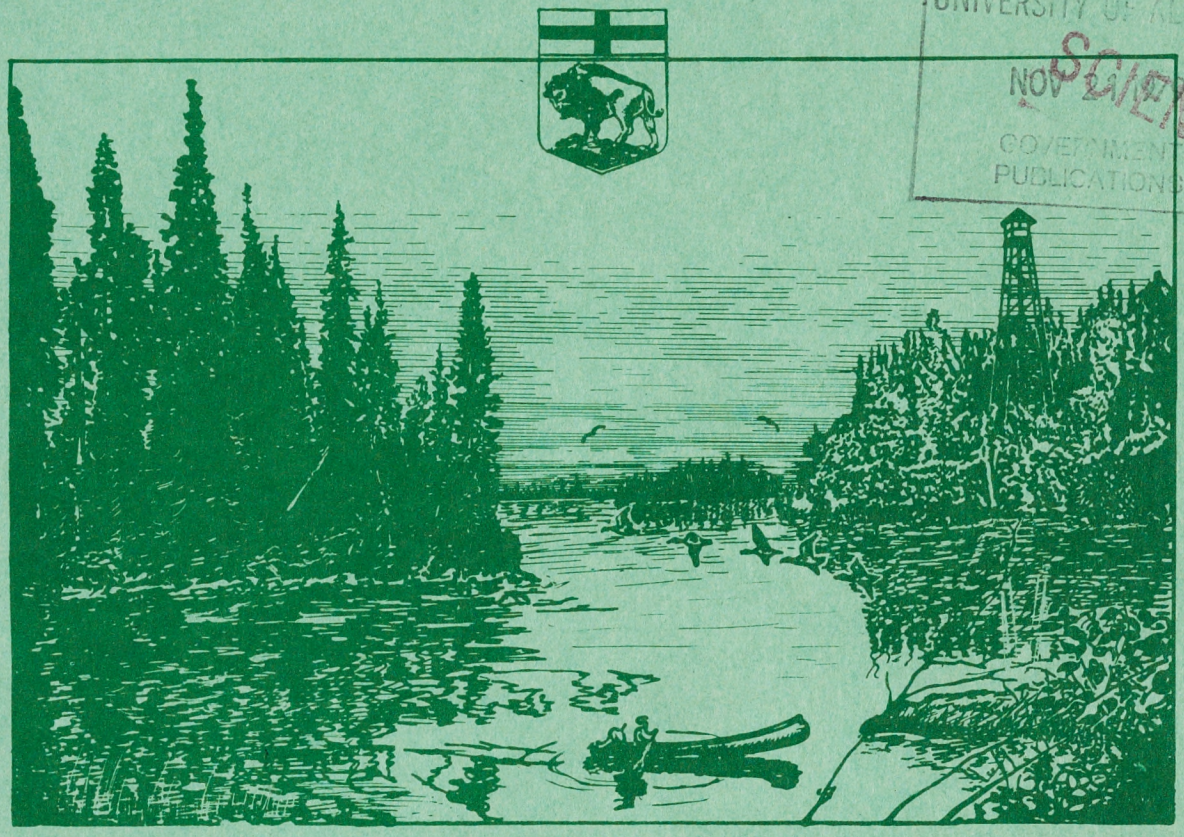
Report No. 6

NELSON RIVER FOREST SECTION



Forest Resources Inventory

1956

FOREST SERVICE
Department of Mines and Natural Resources
PROVINCE OF MANITOBA

Winnipeg, 1959

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Forest Resources Inventory photograph showing the Village of Wabowden.

Preface

This is one of a series of bulletins summarizing the results of the ground and aerial survey work which was completed in 1956 in connection with the latest Forest Inventory of Manitoba. The figures in this new series will replace those previously used based on surveys made between 1927 and 1930, and tabulated in "The Forests of Manitoba, Bulletin 85," published by the Dominion Forest Service in 1934.

For the purpose of the new Forest Inventory the Province has been divided (as shown on Map 1) into four zones based on climate, original vegetation and predicted future use, as follows:

Agricultural	Transition from Forest to Tundra
Forest	Tundra or Barren Lands

The Forest Zone may be defined as the area which is producing or is capable of producing forest crops and which for climatic reasons is, in the main, more suitable for the production of wood than for agricultural crops. The Forest Zone has an over-all area (omitting the three major lakes—Winnipeg, Manitoba and Winnipegosis) of about 113,238 square miles or nearly half the total area of Manitoba (less these lakes).

Based on the presence or absence of transportation routes such as railways, highways and water routes, the Forest Zone is again divided into an Accessible and Inaccessible Area.

The Accessible Forest Zone with an over-all area of about 64,122 square miles has been divided for Inventory purposes into seven main Forest Sections based on physical geography and administrative boundaries, as follows:

Southeastern	Lowlands North
Winnipeg River	Nelson River
Lowlands South	Northern Mining
Mountain	

Each of the Forest Sections is again divided into Working Circles which conform with Forest Ranger Districts, except in the more northerly areas where on account of their large size it has been necessary to subdivide the Ranger Districts. In addition to the seven major Forest Sections listed above, the Accessible Forest includes two minor areas in southern Manitoba—the Spruce Woods and the Turtle Mountain Forest Reserves.

The Inaccessible Forest with an over-all area of about 49,116 square miles has been divided into 20 Inventory Units.

Although a limited amount of the Forest Zone was inventoried before 1951, the main work was done commencing April 1st, 1951, from which date the Federal Government has reimbursed to the Province one-half of the expenditures incurred in forest resources inventory under the terms of an agreement with the Province pursuant to the provisions of the Canada Forestry Act.

A separate report will be published for each of the seven major Forest Sections of the Accessible Area, and an eighth report will cover the Spruce Woods and Turtle Mountain. The whole of the Inaccessible Forest will be covered by an additional report.

An explanation of the method of survey is given in the Appendix.

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Maps

PREPARED BY FOREST MANAGEMENT DIVISION

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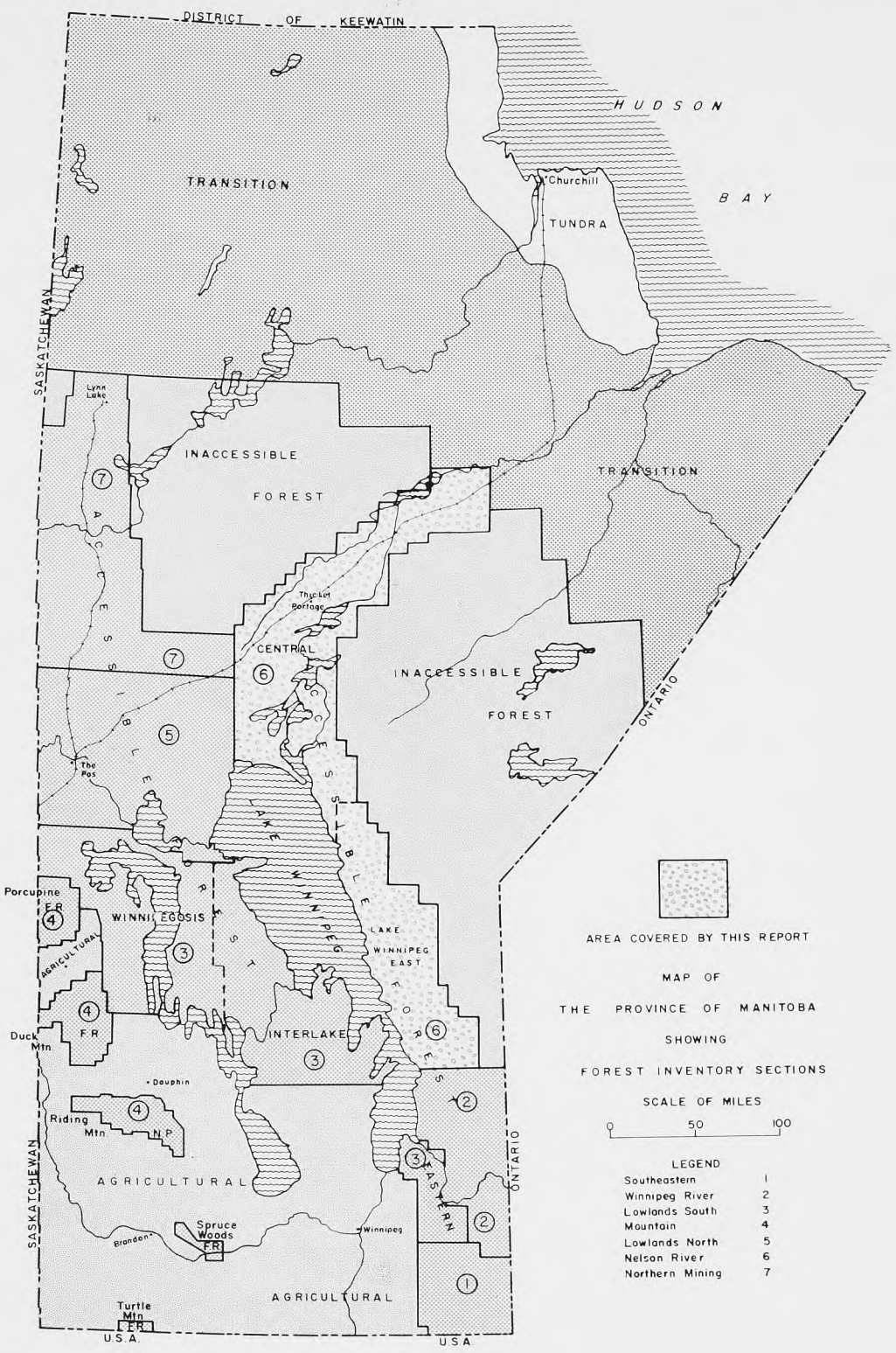
Maps Nos. 1 and 2 by P. Peloquin.

Tables 1 to 12 and figures 1 to 10 by L. Pasterz.

Cover design by D. R. McTavish.


DISTRICT OF KEEWATIN
HUDSON BAY
TRANSITION
Churchill
TUNDRA
SASKATCHEWAN
Lynn Lake
INACCESSIBLE FOREST
ACCESSIBLE
TRANSITION
The Pas
CENTRAL
INACCESSIBLE FOREST
ONTARIO
ACCESSIBLE
LAKE WINNIPEG FOREST
Porcupine F.R.
WINNIPEGOSIS
AGRICULTURAL
LAKE WINNIPEG EAST
Duck Mtn.
F.R.
INTERLAKE
Dauphin
Riding Mtn. N.P.
EASTERN
AGRICULTURAL
Spruce Woods F.R.
Brandon
Winnipeg
Turtle Mtn. F.R.
USA
USA
AREA COVERED BY THIS REPORT
MAP OF
THE PROVINCE OF MANITOBA
SHOWING
FOREST INVENTORY SECTIONS
SCALE OF MILES
0 50 100
LEGEND
Southeastern 1
Winnipeg River 2
Lowlands South 3
Mountain 4
Lowlands North 5
Nelson River 6
Northern Mining 7

Map No. 1

White spruce stands of saw-timber size are often found on lake shores.

Forest Resources

NELSON RIVER FOREST SECTION

Location and Area

A glance at Map No. 1 will show the location of the Nelson River Forest Section with regard to the remainder of the Forest Zone of Manitoba. It will be noted that the Forest Section follows the east shore of Lake Winnipeg, the Nelson River, and the Hudson Bay Railway. These waterways and the railway make the northern portion accessible and have the effect of driving a wedge through the inaccessible forest lying to the northwest and southeast. The Forest Section covers a distance of 350 miles in a north and south direction, but its greatest width in an east and west direction, which is in the vicinity of Norway House, is only 73 miles.

The total area covered by this report and estimate is 10,962,805 acres, which makes this the largest of the forest sections. This area excludes Indian Reserves, but includes all other land and water within the boundaries hatched on Map No. 2. Lake Winnipeg is excluded, but all other water areas are included in the area given above.

The Forest Section has been divided into three subsections based on location with regard to transportation routes. The most southerly, or Lake Winnipeg East subsection, consisting of four working circles, is tributary to Lake Winnipeg. The central, or Norway House, subsection consists of the single Norway House working circle, and is tributary to the north end of Lake Winnipeg, with an alternative route down the Nelson River to the Hudson Bay Railway. The Northern subsection, consisting of four working circles, is tributary to the Nelson River, which river is crossed by the Hudson Bay Railway at one point within the subsection.

Table 1

Area Classification in Acres
Nelson River Forest Section

CLASS OF AREA	Crown Land§ Total Area	*% of land area*
PRODUCTIVE FOREST LAND*	4,357,706	44.9
POTENTIALLY PRODUCTIVE FOREST LAND†	18,474	.2
Clear cut	535	.....
Burn	9,548	.1
Shrub	8,391	.1
NONPRODUCTIVE FOREST LAND‡	3,503,665	36.1
Treed muskeg	2,616,125	27.0
Willow and Alder	125,280	1.3
Treed rock	762,260	7.8
NONFORESTED LAND#	1,826,681	18.8
Farm field	4,929	.....
Barren rock	211,385	2.2
Meadow	1,262	.....
Marsh	191,066	2.0
Muskeg	1,406,913	14.5
Unclassified	11,126	.1
TOTAL LAND	9,706,526	100.0
WATER	1,256,279	12.9
TOTAL AREA	10,962,805	.....

§The amount of Patented Land is insignificant.

*Land supporting merchantable timber or young growth which will produce merchantable timber within a reasonable time.

†Land not now supporting productive forest, but capable of doing so.

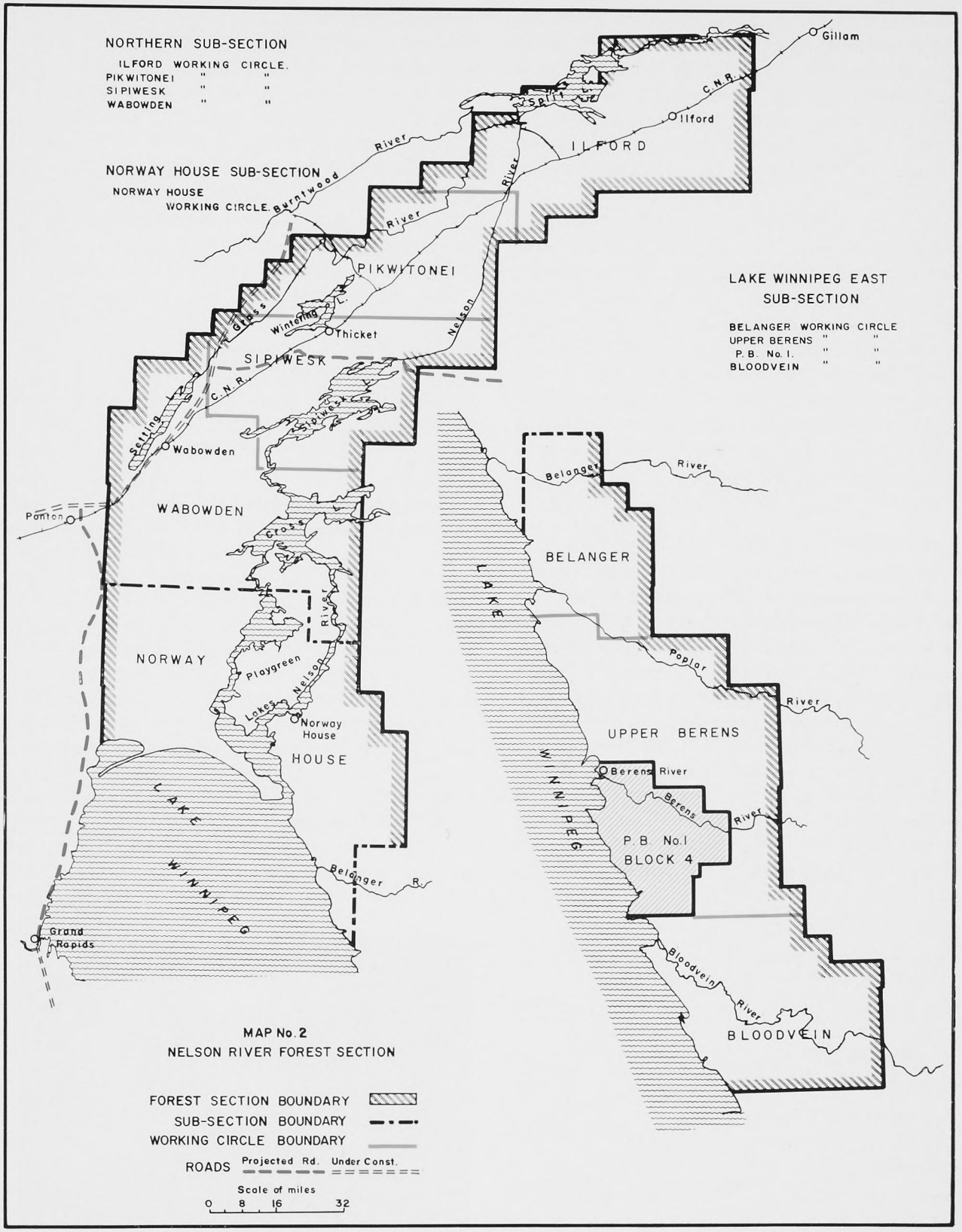
‡Land with a forest cover but incapable of producing a forest crop of merchantable size within a reasonable time.

#In general, lands not expected to produce forest of any kind.

Geology

The surface rock over the whole area is of Precambrian age, consisting mainly of granite and granite-like rocks, with narrow belts of altered sediments and lavas, remnants of ancient rocks which were folded into mountain ranges and later intruded, or replaced, by granite. After many millions of years, erosion had worn down the mountainous country to the peneplain characteristic of the Canadian Shield of which this area forms a part.

A line drawn northeasterly from the north end of Lake Winnipeg crosses the Canadian Shield at a narrow point, and since this line is also one of low elevation some geologists have suggested that it may, at one time, have had a covering of Palaeozoic limestone, which was later removed by erosion. In any case, the limestone now overrides the Precambrian to the north and south, but no trace of surface rock, other than Precambrian, has been found in the area in question.


NORTHERN SUB-SECTION
ILFORD WORKING CIRCLE.
PIKWITONEI " "
SIPIWESK " "
WABOWDEN " "
NORWAY HOUSE SUB-SECTION
NORWAY HOUSE
WORKING CIRCLE.
LAKE WINNIPEG EAST
SUB-SECTION
BELANGER WORKING CIRCLE
UPPER BERENS " "
P.B. No. 1. " "
BLOODVEIN " "
Gillam
C.N.R.
Split L.
Ilford
ILFORD
Burntwood River
River
PIKWITONEI
Gass L.
Winisting L.
Thicket
Nelson River
SIPIWESK
C.N.R.
Setting L.
Sipiwesk L.
Wabowden
Ponton
WABOWDEN
Cross L.
Belanger River
BELANGER
LAKE
NORWAY
Playgreen Lakes
Nelson River
Norway House
HOUSE
Poplar River
UPPER BERENS
Berens River
Berens River
P.B. No.1
BLOCK 4
WINNIPEG
LAKE
WINNIPEG
Belanger R.
Grand Rapids
Bloodvein River
BLOODVEIN
MAP No. 2
NELSON RIVER FOREST SECTION
FOREST SECTION BOUNDARY
SUB-SECTION BOUNDARY
WORKING CIRCLE BOUNDARY
ROADS Projected Rd. Under Const.
Scale of miles
0 8 16 32

Map No. 2

During the Ice Age heavy glaciation took place, indeed, the nodal centres from which the ice spread out in all directions were not far to the north and east. Loose surface material resulting from the previous weathering of rock was swept into the hollows, or removed from the district, and the bed rock surfaces were smoothed and polished by the ice movement.

The ice barrier blocked the main drainage channel which formerly ran to Hudson Bay, with the result that glacial Lake Agassiz was formed in front of it, to the south. The overflow from this lake was diverted to the south, flowing first into the Mississippi, and later into rivers which skirted the ice-sheet to the east, emptying into the St. Lawrence system. Finally, as the ice waned, the original channel to the north was restored. The whole area of the Nelson River Forest Section bears evidence of having been covered for longer, or shorter, periods by this fresh water glacial lake.

Topography

The Nelson River Forest Section may be pictured as a shallow inclined trough, in which Lake Winnipeg and the Nelson River occupy the bottom of the trough. The highest point above sea level is probably Thunder Mountain, a rounded granite outcrop, south of Weaver Lake on the Poplar River, east of Lake Winnipeg, which has an elevation of about 1,000 feet above sea level. The lowest point is at Split Lake where the Nelson River flows out of the Forest Section, the elevation of the water here being 535 feet. Since Lake Winnipeg has an elevation of 713 feet, the Nelson River drops 178 feet between Lake Winnipeg and Split Lake, in a distance which is about 200 miles in a straight line, although a good deal longer by river. The river has a number of lake-like expansions and most of the drop is concentrated in three comparatively short stretches where the river drops over rock barriers. The uppermost series of rapids is above Cross Lake, the second lies between Cross and Sipiwesk lakes, while the lower is just above Split Lake.

The surface topography is determined mainly by the underlying Precambrian rock surface. Like the rest of the Precambrian area, this surface is hummocky, with the tops of the hills and ridges having a common level. The deposition of sediments over hills and hollows by glacial Lake Agassiz had the effect of levelling off the surface to a considerable extent. The tops of the ridges are usually not over 50 feet above the levels of the numerous lakes, although they occasionally rise to over 100 feet above the water.

The rivers draining into Lake Winnipeg from the east are, from south to north, the Bloodvein, Pigeon, Berens, Poplar, Mukutawa, Belanger, and Gunisao. The Minago drains into Cross Lake from the west, through a wide valley which is thought to have been a former outlet of the Saskatchewan River. The Grass River is an important tributary which parallels the Nelson on the west before it enters Split Lake. Further west, a second parallel river is the Burntwood which also drains to Split Lake. Strictly speaking, the Burntwood is outside the area described above as the Nelson River Forest Section, but in the future as transportation improves it will become an important tributary area. "The river valleys are moderately depressed and are made up generally of chains of rock-bound basins which form series of lake-like ex-

Table 2

Classification of Productive Forest Land by Cover Types—Nelson River Forest Section

COVER TYPE	Crown Land§	
	acres	%
S: Over 75% softwood	2,952,894	67.8
M: 50 - 75% softwood	964,476	22.1
N: 25 - 50% softwood	209,352	4.8
H: Under 25% softwood	230,984	5.3
TOTAL	4,357,706	100.0

§The amount of Patented Land is insignificant.

Whitemud Falls on the Nelson River.

pansions along the rivers, the water spilling over the lower part of the rims and flowing from basin to basin with swift current or a succession of rapids and falls."*

Soils

The regional soils of the area belong to the Grey-Wooded great soil group. They have developed from clay textured lacustrine sediments under the influence of conifers and, to a lesser extent, deciduous trees.†

The Nelson River Forest Section is entirely included in what has been described as the Northern Clay Belt of Manitoba. Here on the old Precambrian surface, itself modified by preglacial erosion, and by the advance and retreat of a number of ice-sheets, was laid down a heavy deposit of clay in glacial Lake Agassiz. The clay was deposited evenly over hills and valleys, with the result that the original knob and kettle topography became more gently undulating. The depth of the deposited sediment varies from 10 to 100 feet, being thickest in the Norway House subsection, and the southern part of the Northern subsection, between Ponton and Pikwitonei on the Hudson Bay Railway, and in the adjoining tributary area of the Inaccessible Forest Area to the west along the Burntwood River as far upstream as Nelson House.

Since the draining of the glacial lake, the northern rivers and lakes have in many places exposed the rock surface by current and wave-action so that a traveller on the water routes sees a good deal of granite, and may get an impression that there is a greater area of bare rock and thin soil than is actually the case. In areas of poor drainage, peat soils have been formed by the growth and decomposition of sphagnum moss and accompanying ericaceous shrubs. This type of soil is especially prevalent in the area east of Lake Winnipeg, i.e. the Lake Winnipeg East subsection.

A preliminary soil examination by soil specialists of the Manitoba Soil Survey was made in September, 1952. This party examined soils along the Hudson Bay Railway and also at a number of points east and west of the railway where seaplane

*The Basins of the Nelson and Churchill Rivers, William McInnes, Memoir No. 30, Geological Survey of Canada, 1913.

†Unpublished "Report on Land Inspection of Upper Nelson Area," by W. A. Ehrlich, Manitoba Soil Survey, September, 1952.

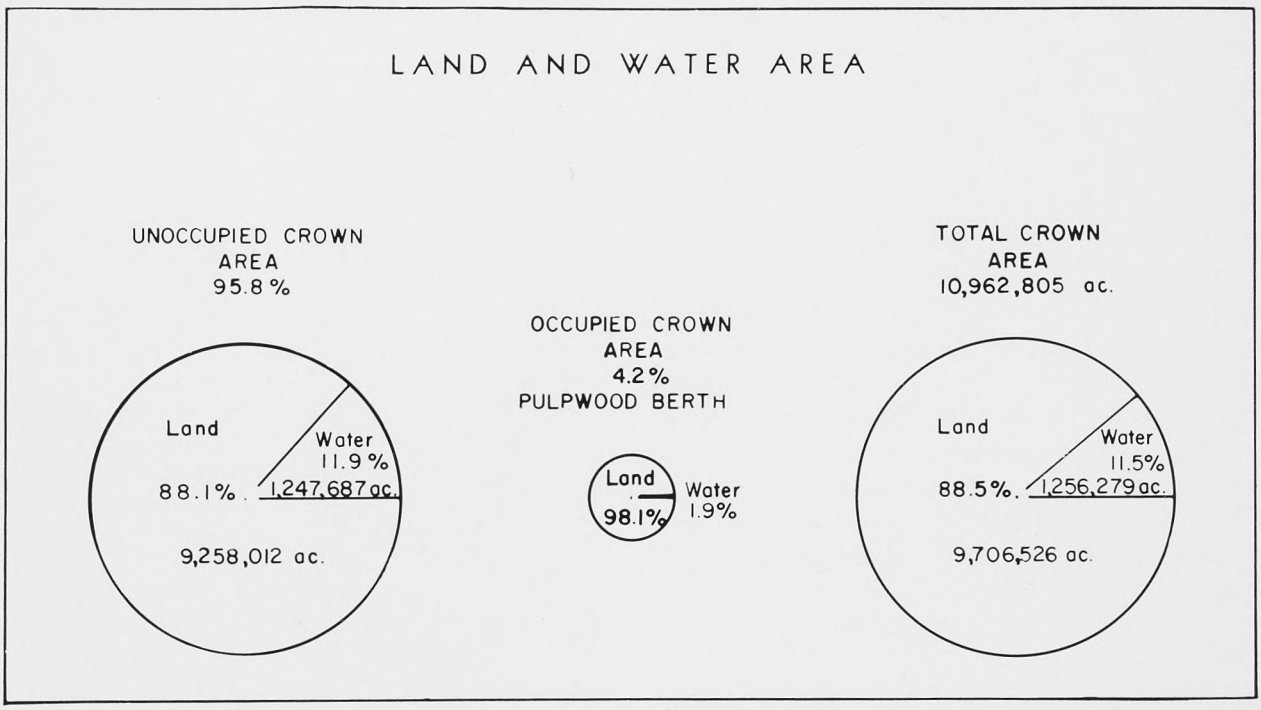


Figure 1.

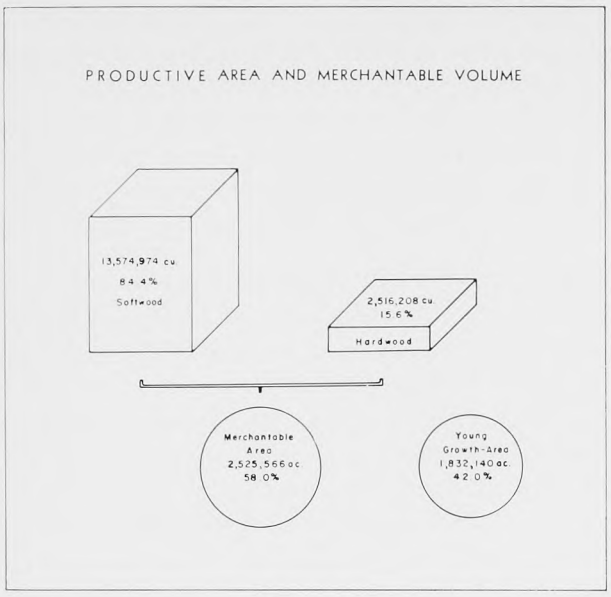


Figure 2.

landings were made. Information from this field examination and from a study of earlier geological survey records was combined, and a report was prepared.* This report which was accompanied by a sketch map, points out that a heart-shaped area of deeper lacustrine clays occurs in a more or less continuous tract which extends northward from Lake Winnipeg to Nelson House, and along the Hudson Bay Railway from below an ancient beach near Ponton to Armstrong Lake, a distance of over 100 miles along the railway. The 1952 field examination revealed clay depths from a thin mantle to 25 feet or more, although early geological reports mention depths up to 100 feet in certain locations.

Outside the heart-shaped area of more or less continuous clay cover described above, there appear to be marginal areas where the clay cover is less continuous but which probably have localized clay deposits of considerable depths. For example, the country around Split Lake and the lower reaches of the Berens River is known to have fairly deep stratified clay soils. Judging by the small extent of rock outcrop in the area east of Lake Winnipeg, and north of Berens River, this is also a clay or silt covered area, and this view is supported by geological and forestry traverses of the Poplar, Mukutawa, Belanger, and Gunisao rivers. However, most of this country is covered by muskeg and treed muskeg except in the immediate vicinity of the rivers, and at certain points on the shore of Lake Winnipeg, despite the fact that the general slope towards the lake appears to be sufficient to allow adequate drainage. This condition of poor drainage may be due to the interposition of concealed rock ridges paralleling the lake, and the fact that lateral drainage into the rivers has not yet had time to develop.

*Unpublished "Report on Land Inspection of Upper Nelson Area," by W. A. Ehrlich, Manitoba Soil Survey, September, 1952.

Climate and Natural Vegetation

The Nelson River Forest Section of the Manitoba Inventory corresponds closely with the accessible portion of the Nelson River Section, B 21, of the Boreal Forest Region, as mapped in "A Forest Classification for Canada," except that the Wekusko and Reed Lake areas are excluded from the Nelson River, and included in the Northern Mining Section in the Provincial Inventory.

White spruce—Partridge Crop Lake.

Table 3

Area Classification of Productive Forest by Age Classes, Cover Types and Merchantability—Nelson River Forest Section

AGE CLASS *years*	COVER TYPES IN ACRES									
	S		M		N		H		Total	
	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.
0 - 20	186,712	.....	126,616	.....	46,116	.....	62,443	.....	421,887	.....
21 - 40	373,424	26,323	294,125	141,498	.....	65,487	56,561	63,681	724,110	296,989
41 - 60	680,103	696,976	5,632	249,170	.....	73,987	.....	31,891	685,735	1,052,024
61 - 80	408	813,974	.....	121,131	.....	22,002	.....	15,501	408	972,608
81 - 100	.....	133,980	.....	25,736	.....	1,760	.....	829	.....	162,305
101 - over	.....	40,994	.....	568	.....	.....	.....	78	.....	41,640
SUBTOTAL	1,240,647	1,712,247	426,373	538,103	46,116	163,236	119,004	111,980	1,832,140	2,525,566
TOTAL	2,952,894		964,476		209,352		230,984		4,357,706	

The main forest types in the merchantable class are white spruce-black spruce, aspen-white spruce, spruce-jack pine, pine-aspen, pure black spruce, and pure jack pine.

White spruce is found on the better drained clay soil sites, and reaches a very good development at such places as Sipiwesk Lake where trees of 24″ and over in diameter at breast height, with heights of 90′ and over, have been recorded. Very good black spruce is sometimes found rather intricately mixed with white spruce, and in these stands the black spruce sometimes reaches sawlog size. Other associations such as pure aspen, aspen and white spruce, with or without small percentages of white birch and balsam fir, spruce-jack pine, and, occasionally, pure jack pine, are also found on the well-drained clay soils.

Excessively drained sites, such as thin soiled rock slopes, or sand ridges, usually have a jack pine cover. Pure stands of black spruce are predominant where drainage is not so good, the condition of these stands depending mainly on the amount of drainage, varying from excellent pulpwood stands down to stagnated stands.

Some of the above types are considered to be temporary. It has been noted that advance growth in the black spruce-white spruce type is black spruce; in the mixed types, it is usually a mixture of black spruce, white spruce, and balsam fir; in the jack pine-spruce type, it is black spruce; in the jack pine type, it is apt to be white spruce. Many young poplar and jack pine stands have an understory of spruce. It seems obvious that the proportion of spruce will be greater in future stands provided fire is kept out.

The native vegetation of a region is the best guide to the climate, and in this connection it is of interest to quote the remarks made by a forester who explored this area in connection with the location of the Hudson Bay Railway—"On well drained sites as far north as Split Lake, the flora is almost identical with that of similar sites on the Riding Mountains of Manitoba, proving that during the growing season these localities lie under one and the same isotherm, or nearly so."* We still lack long term weather records of the two areas, but more recent studies would appear to bear out the essential truth of the statement. It seems likely that a slightly lower summer temperature in the northern area is more or less compensated by the longer hours of sunshine. For example, at the summer solstice Wabowden has about a one hour longer period of possible sunshine per day than Winnipeg.

The forest section is so large, the meteorological stations so few, and their period of weather recording so short in most cases, that only approximate figures can be given on climate. Fortunately, a 40-year record is available from Norway House, and

*Timber Conditions along the proposed route of the Hudson Bay Railway, Bulletin 17, Forest Service, Department of the Interior—1911.

as this point is in a central position so far as latitude is concerned, it is possible, using data from here and from other points with shorter records, to arrive at approximate figures for the forest section as a whole. On this basis, the annual precipitation is from 15 to 21 inches, increasing towards the south. Indications are that August is the wettest month, followed by July, June, and September, in that order. The average mean daily maximum temperature for July is from 70 to 75 degrees above, and the mean daily minimum for January is from 15 to 30 degrees below zero. The average length of the period free from killing frost, taken as 29.5°, ranges from 120 to 104 days, and the frost free period, using 32.5°, is from 96 to 80 days.

Early History

The original inhabitants of the Nelson River Forest Section, so far as can be known, belonged to the Cree tribe, a subdivision of the great Algonkian stock which inhabited the Boreal Forest Region of Canada, all the way from Newfoundland to the Athabaska River. The Cree are still the main Indian inhabitants of the Nelson River area, although at a later date, about the year 1800, the Ojibwa Indians, a related tribe, also of the Algonkian stock, moved in from the east and are now found in intermixture with the Cree as far north as the Bloodvein and Berens rivers.

When the English fur-traders from the shores of the Hudson Bay first made contact with the natives at about the end of the 17th century, the Indians

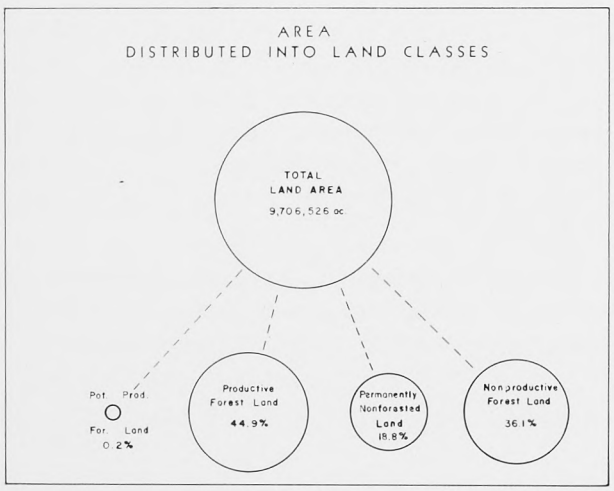


Figure 3.

Table 4

Softwood and Hardwood Volume by Age Classes and Cover Types
Nelson River Forest Section

AGE CLASS *years*	*VOLUME IN CUNITS BY COVER TYPES (1 Cunit equals 100 cu. ft. of Wood)													
	S			M			N			H			Total	
	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total
0 - 20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21 - 40	119,476	13,271	132,747	465,299	184,259	649,558	118,105	123,545	241,650	37,794	162,347	200,141	740,674	483,422	1,224,096
41 - 60	3,397,751	189,016	3,586,767	1,188,009	434,501	1,622,510	248,850	243,142	491,992	33,959	160,713	194,672	4,868,569	1,027,372	5,895,941
61 - 80	4,598,709	235,973	4,834,682	852,624	297,895	1,150,519	123,069	124,799	247,868	27,452	136,580	164,032	5,601,854	795,247	6,397,101
81 - 100	1,755,310	84,631	1,839,941	230,330	81,479	311,809	9,082	12,465	21,547	1,396	10,897	12,293	1,996,118	189,472	2,185,590
100 - over	358,005	17,360	375,365	9,702	2,566	12,268	.....	.....	.....	52	769	821	367,759	20,695	388,454
TOTAL	10,229,251	540,251	10,769,502	2,745,964	1,000,700	3,746,664	499,106	503,951	1,003,057	100,653	471,306	571,959	13,574,974	2,516,208	16,091,182

*Net roundwood volume: stump height 1', top diameter 3"; one stacked cord equals approximately 85 cu. ft. of wood.

Young spruce under birch—Split Lake. The spruce will gradually replace the birch.

had the primitive economy of the hunting stage. There were no permanent settlements as the bands were more or less continually on the move in search of food, which consisted of game, fish, wild fruit, and edible roots. Dwellings were portable wigwams covered with skins, bark, or rush mats.

For weapons, the early Indians depended on the bow and arrow, and the spear. Stone was shaped into cutting edges for use as arrowheads, spear points, and knives. Bone was used as scrapers for dressing hides, and for awls for piercing skin and bark. Fish nets and snares were made from willow bark, or from rawhide.

Wood was, of course, used for cooking, and for heating the wigwams, but there were several more interesting uses. The forest Indians have contributed three important articles, largely made of wood, to the white man's culture—the canoe, snowshoe, and toboggan. To the Indian, the white birch may have been the most important tree as its bark furnished the covering for his canoe, sometimes for his wigwam, and commonly for cooking vessels, table dishes, etc.*

During the first century after the establishment of trading posts on the shores of Hudson Bay no inland posts were established by the company of that name. However, it was customary to send white men inland with the Indians for the purpose of exploration, establishing new trading areas, and to keep peace between the different bands and tribes of Indians. Records show that Henry Kelsey from York Factory traversed the Nelson River area in 1690-91, probably by way of Cross Lake and the Minago River.

As early as 1732, advance parties of La Verendrye's men coming from Montreal were able to intercept Indians at the north end of Lake Winnipeg, who were en route to Hudson Bay; and were able to divert some of the trade. In 1774, the year the Hudson's Bay Company established their first inland post on the Saskatchewan, the predecessors of the Northwest Company of Montreal had established a post at the north end of Lake Winnipeg at the point where the Nelson River commences.

The Nelson River might appear to be the natural route from York Factory inland, but on account of the long series of rapids in its lower reaches, it was customary to use the Hayes River and its tributaries in starting out from the Bay, and then to intercept the Nelson at some point upstream. The Nelson River could be reached from the Hayes system by at least three routes, coming out at Split Lake, Cross Lake, and by the Echimamish River, respectively. In earlier years the first two routes appear to have been favoured, but in later years, after the use of the heavy York boats had become established, the Hayes River-Echimamish route became the main route. As a consequence, Norway House, near the outlet of the Nelson River from Lake Winnipeg, became an important post.

During the period of extreme competition between the Montreal fur-traders and the Hudson's Bay Company, from about 1770 to the union of the two companies in 1821, many posts were established in the Nelson River Forest Section. Records show that the Northwest Company had posts at

*The Algonkians, Leaflet 1, National Museum of Canada, 1938.

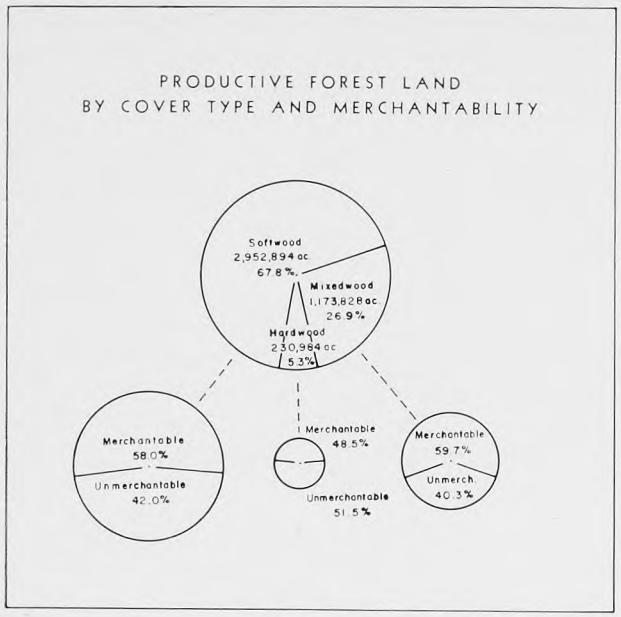


Figure 4.

Jack River (near Norway House), Paint Lake, Sipiwesk Lake, and Cross Lake. The Hudson's Bay Company, in turn, established posts at Split Lake, Wintering Lake, Sipiwesk Lake, Setting Lake, and Norway House.

The post at Sipiwesk Lake which was built on a rocky promontory at the north end of the lake in 1792 is of special interest because it was established by David Thompson, the famous explorer and map-maker.

After 1821, when the Hudson's Bay and Northwest companies united, the Nelson River region enjoyed peace and quiet, but there was no development of the north country except in the ordinary course of the fur trade. The trade in and out of York Factory increased with the closing of the Montreal route. The main route for transportation of trade goods and furs for the western plains and the northern forest continued to be by way of the Hayes River-Echimamish route and through Norway House, being gradually diminished with the advent of railways from the south.

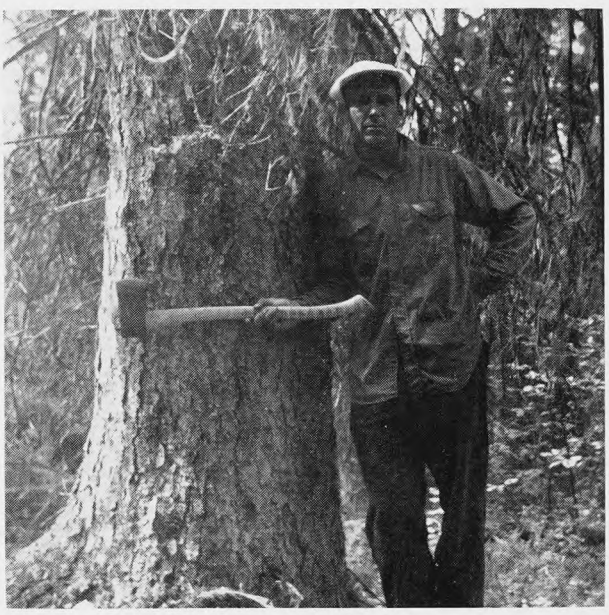
Development of the Area

Modern development of the Nelson River Forest Section had to await the construction of the Hudson Bay Railway. Although the rails reached The Pas in 1910, due to the outbreak of the First World War, and also to uncertainty as to which seaport should be developed, it was not until 1929 that the railway was completed to Churchill. Even now, it may be said that development has scarcely commenced although there has been accelerated progress in recent years.

Lumbering was for a long time limited to the operation of sawmills at the various Indian Reserves and missions where lumber was produced for local use. In recent years the production of lumber, railway ties, and mining timber has been stimulated by the development of large scale mining operations in adjacent areas.

The pulp and paper industries of the south began to reach into this district for spruce pulpwood, suitable for the production of newsprint, in, or about, 1945; since that time there has been considerable production in areas adjacent to the railway as far north as Sipiwesk, Setting, and Wintering lakes, despite the handicap of high freight rates on the Hudson Bay Railway. No pulpwood concessions have been granted although there is a large volume of merchantable timber and a great area of productive forest land available for development by forest industry.

Up to date there have been no important mining operations in this forest section, but it is already benefiting by the development of large scale mining activity in the immediate vicinity, in the Mystery Lake area. This project of the International



White spruce—Paint Lake.

Table 5

Softwood and Hardwood Volume by Cover Types and Size Classes
Nelson River Forest Section

COVER TYPE	VOLUME IN CUNITS (100 cu. ft. Units)								
	Softwood			Hardwood			Total		
	4" 9"	10" +	Total	4" - 9"	10" +	Total	4" - 9"	10" +	Total
S	9,124,966	1,104,285	10,229,251	440,035	100,216	540,251	9,565,001	1,204,501	10,769,502
M	2,155,461	590,503	2,745,964	816,564	184,136	1,000,700	2,972,025	774,639	3,746,664
N	399,285	99,821	499,106	434,193	69,758	503,951	833,478	169,579	1,003,057
H	81,338	19,315	100,653	416,855	54,451	471,306	498,193	73,766	571,959
TOTAL	11,761,050	1,813,924	13,574,974	2,107,647	408,561	2,516,208	13,868,697	2,222,485	16,091,182

Table 6

Softwood and Hardwood Volume by Species and Size Classes
Nelson River Forest Section

SPECIES	*CUNITS BY DIAMETER CLASSES						†SAW TIMBER 10" and Over
	Total		4" - 9" D.B.H.		10" and Over D.B.H.		
	volume	*per cent*	*volume*	*per cent*	*volume*	*per cent*	*M. ft. b.m.*
White spruce	1,830,990	11.4	1,027,510	7.4	803,480	36.2	361,566
Black spruce	9,122,175	56.7	8,509,216	61.4	612,959	27.6	275,832
Balsam fir	444,623	2.8	394,085	2.8	50,538	2.3	22,742
Jack pine	2,112,454	13.1	1,766,850	12.7	345,604	15.5	155,522
Tamarack	64,732	0.4	63,389	0.5	1,343	.....	604
TOTAL SOFTWOOD	13,574,974	84.4	11,761,050	84.8	1,813,924	81.6	816,266
Aspen	1,604,845	9.9	1,333,021	9.6	271,824	12.2	122,321
Balsam poplar	687,790	4.3	570,866	4.1	116,924	5.3	52,616
White birch	223,573	1.4	203,760	1.5	19,813	0.9	8,915
TOTAL HARDWOOD	2,516,208	15.6	2,107,647	15.2	408,561	18.4	183,852
TOTAL ALL SPECIES	16,091,182	100.0	13,868,697	100.0	2,222,485	100.0	1,000,118

*One cunit equal's 100 cubic feet of wood; one cord equals 85 cubic feet of wood.

†Saw timber figures were obtained by converting the cubic foot volume of the size class, 10" D.B.H., and over to board feet on the assumption that one cubic foot is equal to 4.5 board feet.

Nickel Company has already led to the construction of two branch lines leaving the Hudson Bay Railway—one near Thicket Portage serving the new mining town of Thompson, and a second leading into the Kelsey hydro-electric plant on the Nelson River above Split Lake.

The ultimate capacity of the Kelsey hydro-electric site may be as high as 300,000 kilowatts, which is sufficient for full development of the International Nickel Company project, leaving an ample surplus capacity for a pulp and paper mill of 500 tons daily capacity or larger. In addition to the Kelsey plant the Nelson River has a number of other prospective power sites of large capacity. Two of these are upstream, i.e. south of the Kelsey plant—one being on the stretch of river between

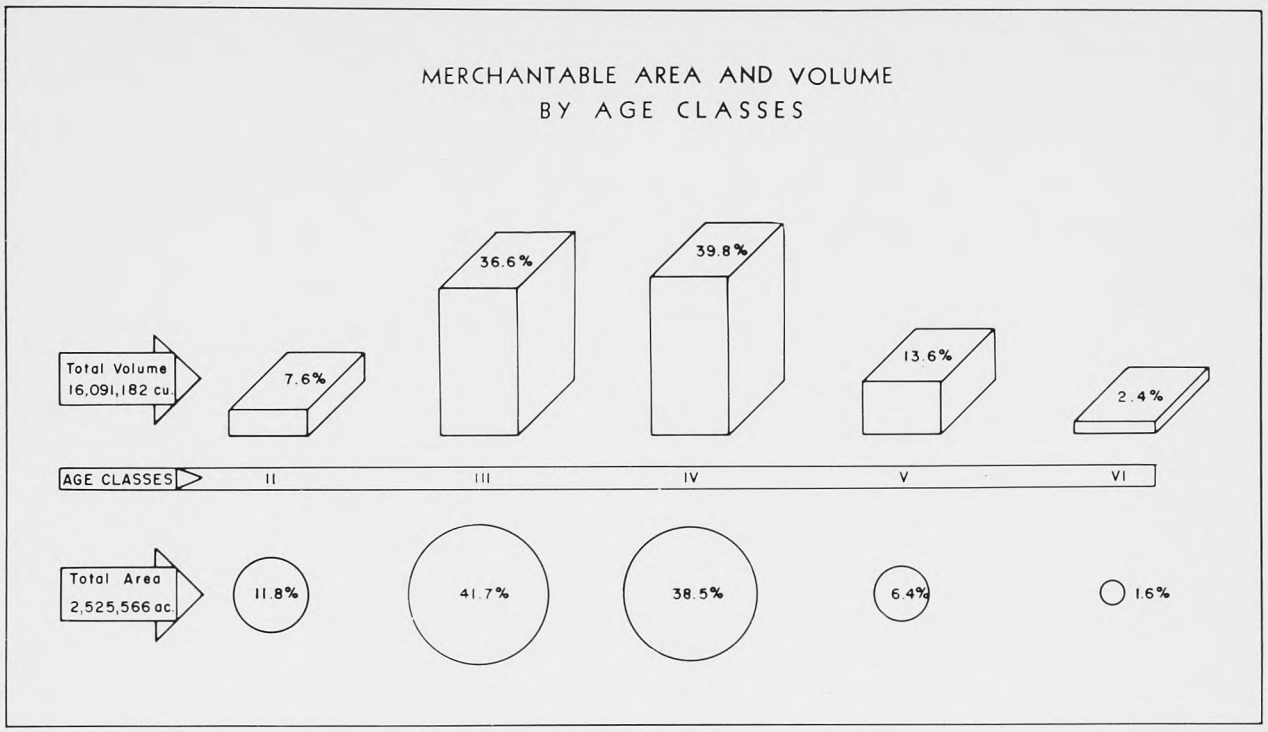


Figure 5.

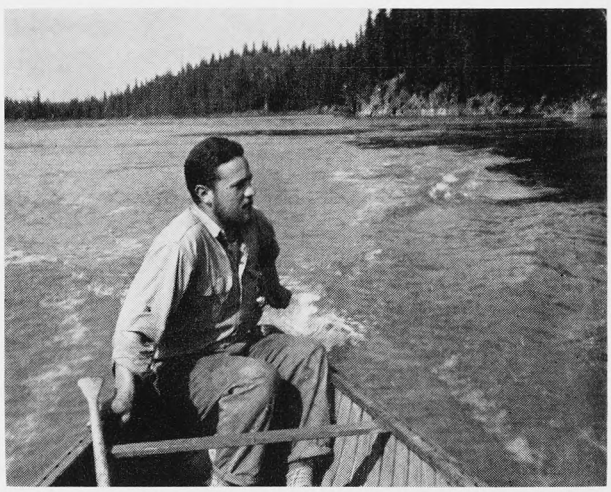
Sipiwesk and Cross lakes, and another between Cross Lake and Lake Winnipeg.

Additional power on a large scale may shortly be available from the development of the Grand Rapids site on the lower Saskatchewan River, see Inventory Report No. 5—"Lowlands North Forest Section." There are also available numerous power sites of lesser capacity on the smaller streams, such as the Grass, Burntwood, Berens, and other rivers.

Fur production in this district is regulated under the registered trapline system, first introduced here in 1940. Fur products include beaver, muskrat, otter, mink, weasel, fisher, fox, marten, lynx, wolf, and skunk. Moose and deer are found throughout the area. Woodland caribou are found in the southern part of the area, and barren ground caribou in the north, during the winter migration. Ducks, geese, and grouse are plentiful in all sections of the area.

The preliminary inspection of the northern clay belt made in 1952 by the soil specialists of the Manitoba Soil Survey, mentioned above under "Soils," led in 1953 to the establishment of an experimental agricultural station at Wabowden, for the purpose of obtaining essential data regarding the growth of coarse grain, hay, and vegetable crops.

Up to the present time this forest section has had no highway connection to southern Manitoba. Under the Natural Resources road program a highway is now being planned for early construction, which will extend No. 10 Highway through the Wabowden, Sipiwesk, and Pikwitonei working circles to the town of Thompson. It is anticipated



Cruising on Nelson River—black and white spruce on shore.

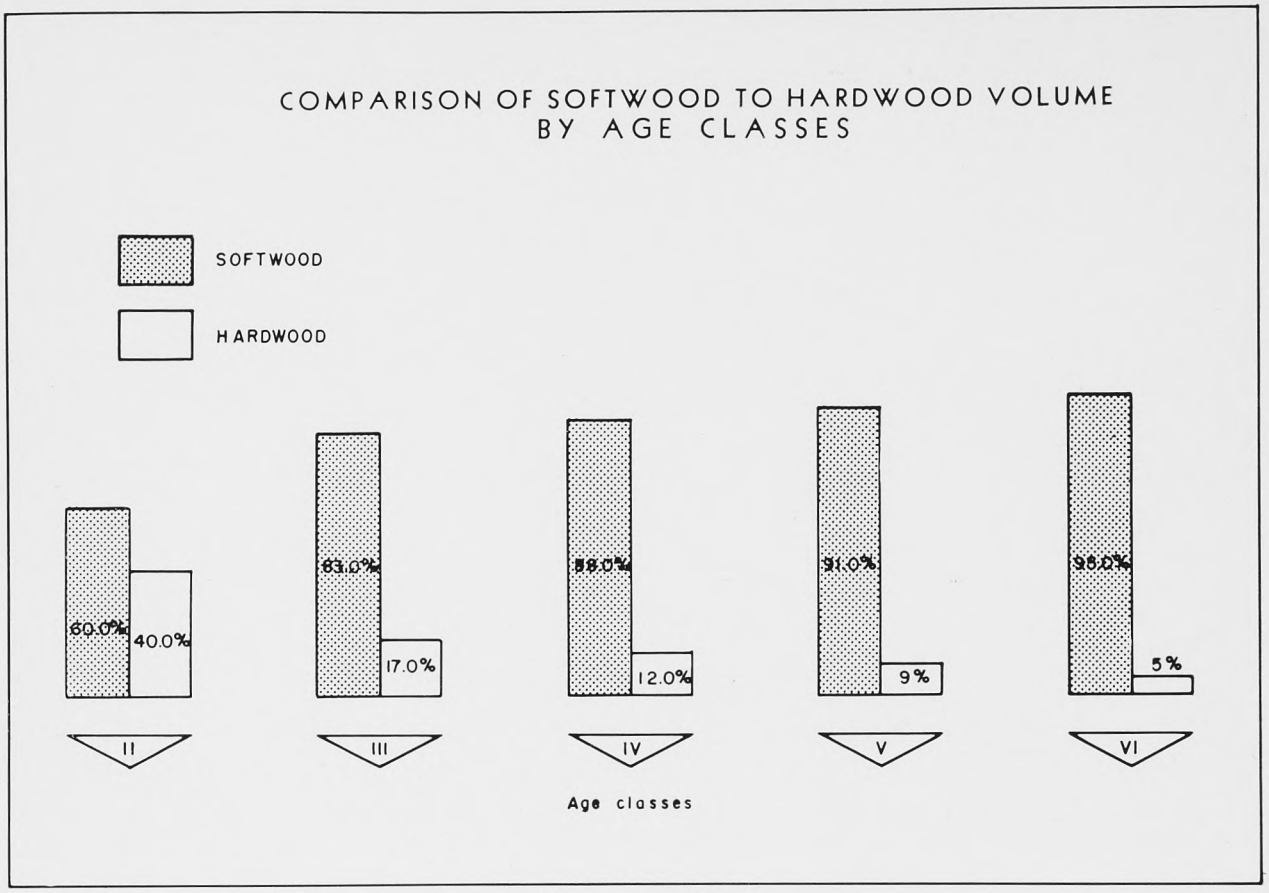


Figure 6.

that another highway link to the south will be constructed from a point on this road, on or near the Hudson Bay Railway, southward through Grand Rapids on the Saskatchewan River and connecting with southern highways at Gypsumville. A branch road is also projected leading off from the main north-south road in the vicinity of Thicket Portage and extending, ultimately, to Gods and Island lakes, see Map No. 2.

The population of the forest section is estimated at around 5,000, about 3,800 of whom are Indians, 700 metis and 500 white. The Indian population is located mainly on the reserves, which in order of population, are located at Norway House, Cross Lake, Split Lake, Berens River, Poplar River, and Bloodvein. There has been an increasing tendency during recent years for Indians to accept work on the railway or in mining and timber operations. The white population tends to be concentrated in the villages along the railway of which Wabowden is the largest. The metis are widely scattered with the largest concentration at Norway House. There are two considerable communities located not far outside the forest section. One of these is the modern mining community of Thompson, and the other, the Indian Reserve at Nelson House.

Forest Administration

In an undeveloped area such as this, where little timber is being cut, the most important phases of forest administration are fire protection and forest surveys—the first to protect the growing stock for future development, and the second as a preliminary to the initiation of development.

Organized fire protection started with canoe patrol on the rivers and lakes about 1912, later, supplemented by railway speeder patrol when the Hudson Bay Railway reached this area. The next advance was made in 1921 when aircraft first began to be used, patrolling as far north as Norway House in that year. The Royal Canadian Air Force later established summer bases at Norway House and Cormorant Lake, from which points hydro-

Table 7

Cubic Foot Volume per Acre Softwood and Hardwood by Age Classes and Cover Types—Nelson River Forest Section

AGE CLASS *years*	VOLUME IN CUBIC FEET PER ACRE BY COVER TYPES														
	S			M			N			H			Total		
	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total
0 - 20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21 - 40	454	50	504	329	130	459	180	189	369	59	255	314	249	163	412
41 - 60	488	27	515	477	174	651	336	329	665	106	504	610	463	97	560
61 - 80	565	29	594	704	246	950	559	567	1,126	177	881	1,058	576	82	658
81 - 100	1,310	63	1,373	895	317	1,212	516	708	1,224	168	1,315	1,483	1,230	117	1,347
100 - Over	874	42	916	1,708	452	2,160	.....	.....	.....	67	986	1,053	883	50	933
MERCHANTABLE	597	32	629	510	186	696	306	308	614	90	421	511	537	100	637
PRODUCTIVE FOREST	347	18	365	284	104	388	238	241	479	44	204	248	311	58	369

Table 8

Area Classification by Subsections—Nelson River Forest Section

SUBSECTION	LAND CLASSES IN ACRES					
	Productive Forest		Potentially Productive	Non-Productive Forest	Permanently Nonforested Land	Total Land
	Unmerchantable	Merchantable				
UNOCCUPIED—						
Lake Winnipeg East	418,826	373,031	1,775	1,414,546	1,022,594	3,230,772
Norway House	227,299	348,920	298	590,323	527,805	1,694,645
Northern	1,123,505	1,655,507	13,212	1,280,277	260,094	4,332,595
TOTAL UNOCCUPIED	1,769,630	2,377,458	15,285	3,285,146	1,810,493	9,258,012
OCCUPIED—						
Pulpwood Berth No. 1, Block 4, Lake Winnipeg East	62,510	148,108	3,189	218,519	16,188	448,514
TOTAL OCCUPIED	62,510	148,108	3,189	218,519	16,188	448,514
GRAND TOTAL	1,832,140	2,525,566	18,474	3,503,665	1,826,681	9,706,526

planes patrolled the forest area of northern Manitoba and furnished transportation for suppression crews. At the present time, air patrol and transportation of suppression crews, equipment, and supplies, is done by the Manitoba Government Air Service, which operates summer bases at Norway House and Thicket Portage, supported by main bases at Lac du Bonnet and The Pas.

There are now nine steel lookout towers within this forest section, and there are a number of towers outside the boundaries which are also used in locating fires by triangulation. It is planned to have other towers built shortly in order to raise the standard of fire detection.

Initial fire planning has been done for the whole Northern Forest District, based on the species composition as given in the forest inventory. The fire plan sets down the "acceptable" area of burn for each Ranger District and Working Circle. Priority

Cruiser's canoe at Pikwitonei.

Table 9

Area Classification of Productive Forest by Subsections, Cover Types, and Merchantability—Nelson River Forest Section

SUBSECTION	AREA IN ACRES									
	S		M		N		H		Total	
	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.
UNOCCUPIED—										
Lake Winnipeg East	234,190	205,572	104,341	101,895	46,116	45,535	34,179	20,029	418,826	373,031
Norway House	207,888	303,484	15,659	38,732	.....	4,857	3,752	1,847	227,299	348,920
Northern	739,356	1,098,847	303,951	367,068	.....	105,955	80,198	83,637	1,123,505	1,655,507
TOTAL UNOCCUPIED	1,181,434	1,607,903	423,951	507,695	46,116	156,347	118,129	105,513	1,769,630	2,377,458
OCCUPIED—										
Pulpwood Berth No. 1, Block 4, Lake Winnipeg East	59,213	104,344	2,422	30,408	.....	6,889	875	6,467	62,510	148,108
TOTAL OCCUPIED	59,213	104,344	2,422	30,408	.....	6,889	875	6,467	62,510	148,108
SUBTOTAL	1,240,647	1,712,247	426,373	538,103	46,116	163,236	119,004	111,980	1,832,140	2,525,566
TOTAL	2,952,894		964,476		209,352		230,984		4,357,706	

zoning for fire protection, based on accessibility and merchantability, has also been established. The whole of the Nelson River Forest Section except the Ilford working circle at the extreme north has been given first priority.

In 1910, the first forest survey work was done, when a six-man party traversed the country, coming in by way of Moose Lake and Mitishto River, following the Grass River through Setting, Paint, and Partridge Crop lakes, crossing to the Nelson River by way of Wintering and Landing lakes; thence, upstream on the Nelson through Sipiwesk and Cross lakes, and returning to Moose Lake by way of the Minago River. This survey was of an exploratory nature, but in 1928 and 1929 a more detailed survey involving the use of aerial photographs and extensive field work was completed, covering the country in the vicinity of the Nelson River between Norway House and the north end of Sipiwesk Lake. Work of a similar nature was also done at this time along the course of the rivers flowing into Lake Winnipeg from the east.

General forest administration of most of the Nelson River Forest Section is carried on under the direction of the District Forester for the Northern Forest District, located at The Pas. Forest Ranger stations within the forest section are located at Norway House and Thicket Portage. The Bloodvein and Berens River working circles, see Map No. 2, are part of the Lake Winnipeg East Ranger District which has headquarters at Lac du Bonnet, and is administered by the District Forester for the Eastern Forest District, located in Winnipeg.

Area Classification and Forest Composition

Table 1 shows that 44.9 per cent of the total land area of the Nelson River Forest Section has been classified as productive forest land, and 0.2 per cent as potentially productive, or a total of 45.1 per cent capable of producing forest crops. Nonproductive forest occupies 36.1 per cent of the land, the larger part of this category being classed as treed muskeg. The remaining 18.8 per cent of the land comes under the general heading "nonforested."

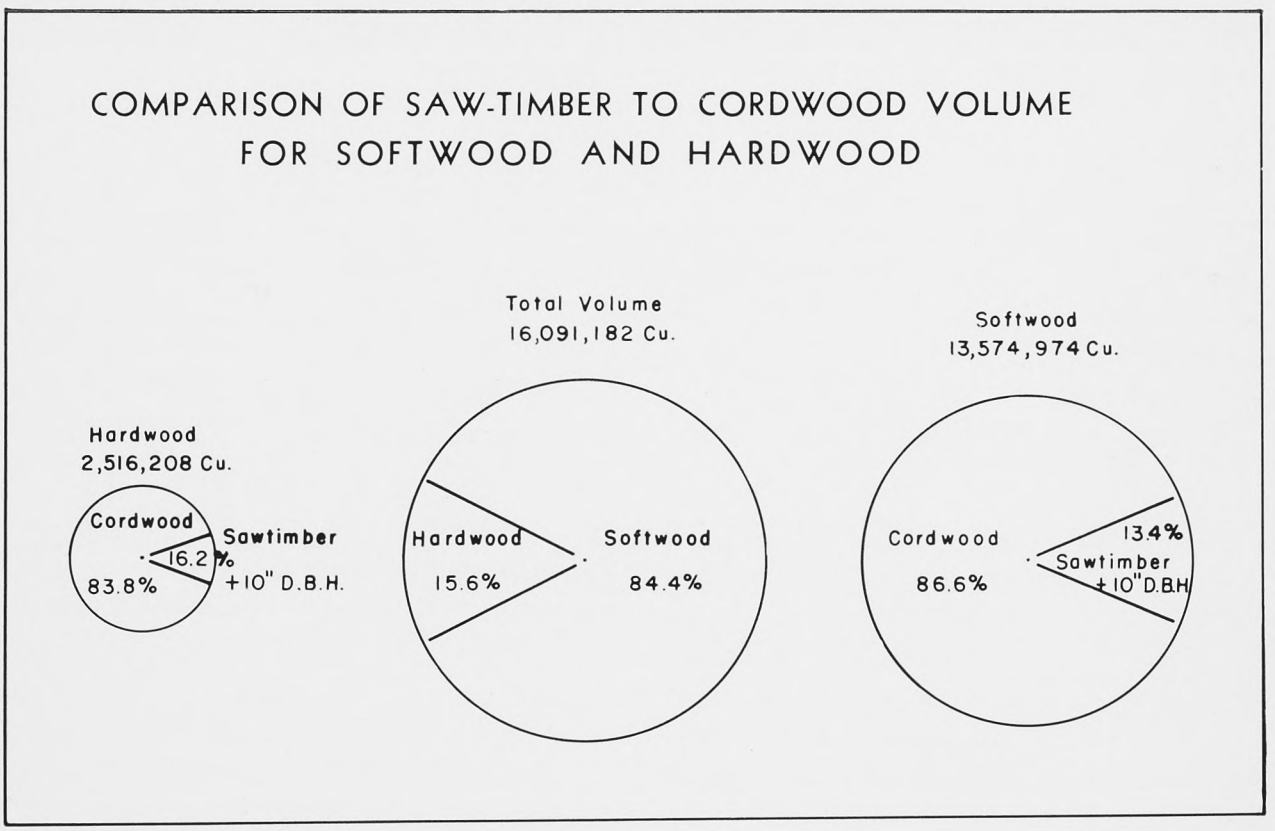


Figure 7.

Table 2 shows that a high percentage of the productive forest area is occupied by softwoods. The combined "S" and "M" cover types (50-100 per cent softwood) make up 89.9 per cent of the whole, leaving only 10.1 per cent for the combined "N" and "H" cover types (0-50 per cent softwood).

Table 6 shows the species distribution by volume. It will be noted that black spruce leads with 56.7 per cent of the total, followed by jack pine, white spruce, and aspen, in that order. The two spruce species together make up 68.1 per cent of the total volume.

Reference is made to Tables 1 to 7 which give area and volume data for the whole forest section, and to Tables 8 to 12 giving similar information by subsections. Further information is available by working circles and by townships, and this information can be made available to interested parties.

Table 13 is a basic table in that it shows volume per acre of stands of various densities and heights (all species combined), and thus shows the yield which can be expected from mature and fully stocked stands with adequate fire protection and silviculture. Many of the existing stands show poor stocking, not on account of unfavourable climate or site, but because past fires have thinned them out at some stage in their development. Records from cutting and from intensive timber cruises indicate that well stocked stands will yield at maturity from 15 to 35 cunits of merchantable wood per acre, depending on species and site.

Forest Inventory

Good control for mapping purposes was available in the Norway House and Northern subsections, from the principal meridian, and base lines, while the Northern subsection had the advantage of subdivided townships along the Hudson Bay Railway as far north as Mileage 222, measured from The Pas. Adequate control was also in existence along the east shore of Lake Winnipeg but was lacking inland from the lake. This gap was filled by Surveys Branch winter traverses of a winter road running east from Berens River, and of the Mukutawa River further north.

Aerial photography of the vertical type covered the area during the summers of 1946, 1950, 1952, and 1953. The scale used in the main timber area, from Norway House north to beyond Pikwitonei, was 1:15,840, the balance being at a scale of

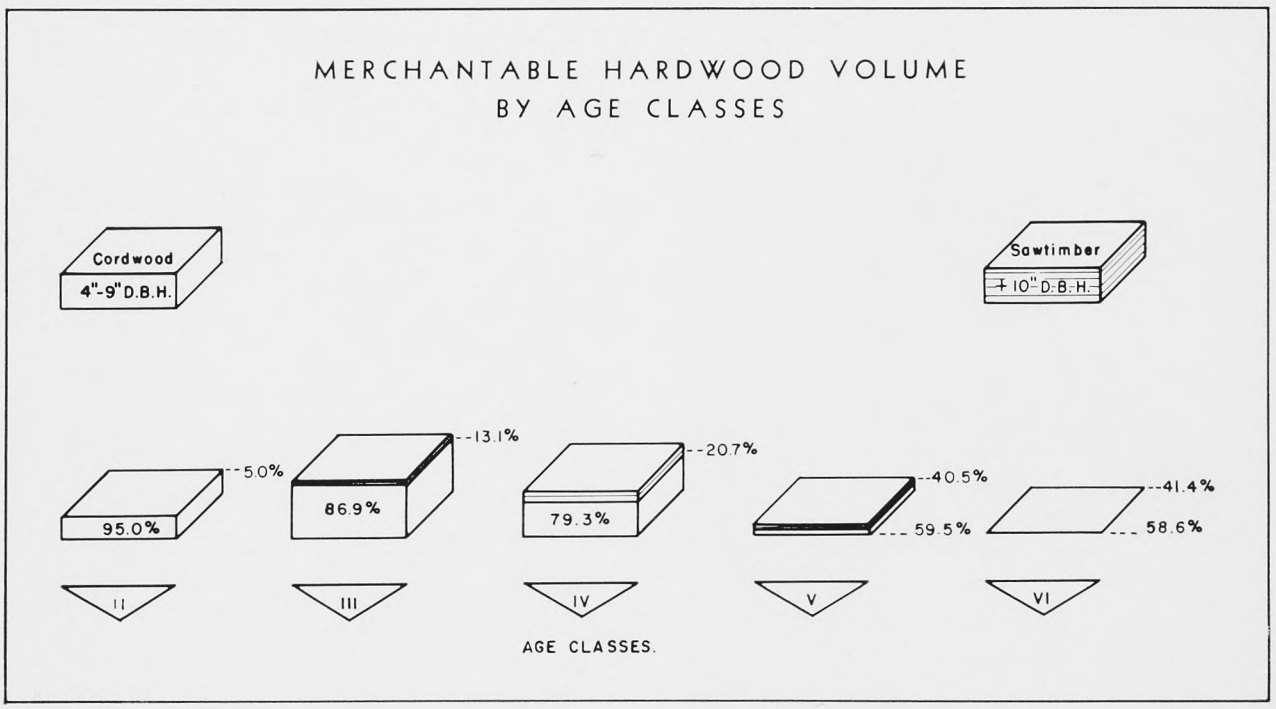


Figure 8.

Table 10

Softwood and Hardwood Volume by Size Classes and Subsections
Nelson River Forest Section

SUBSECTION	VOLUME IN CUNITS (100 cu. ft. Units)					
	Softwood		Hardwood		Total	
	4″ - 9″ D.B.H.	10″ + D.B.H.	4″ - 9″ D.B.H.	10″ + D.B.H.	4″ - 9″ D.B.H.	10″ + D.B.H.
UNOCCUPIED—						
Lake Winnipeg East	1,594,196	171,101	418,900	47,627	2,013,096	218,728
Norway House	1,601,893	193,949	159,306	32,123	1,761,199	226,072
Northern	7,501,771	1,119,407	1,418,923	261,982	8,920,694	1,381,389
TOTAL UNOCCUPIED	10,697,860	1,484,457	1,997,129	341,732	12,694,989	1,826,189
OCCUPIED—						
Pulpwood Berth No. 1, Block 4, Lake Winnipeg East	1,063,190	329,467	110,518	66,829	1,173,708	396,296
TOTAL OCCUPIED	1,063,190	329,467	110,518	66,829	1,173,708	396,296
GRAND TOTAL	11,761,050	1,813,924	2,107,647	408,561	13,868,697	2,222,485
PER CENT	86.6	13.4	83.8	16.2	86.2	13.8

1:31,680 or 1:36,000. The area east of Lake Winnipeg (1:31,680 scale), and parts of the Wabowden, Sipiwesk, and Pikwitonei working circles (1:15,840 scale) was photographed under contract by Spartan

Chief of party using stereoscope in field.

Table 11

Softwood and Hardwood Volume by Subsections
Nelson River Forest Section

SUBSECTION	*VOLUME IN 100 CUBIC FOOT UNITS (Cunits)		
	CROWN LANDS		
	Softwood	Hardwood	Total
UNOCCUPIED—			
Lake Winnipeg East	1,765,297	466,527	2,231,824
Norway House	1,795,842	191,429	1,987,271
Northern	8,621,178	1,680,905	10,302,083
TOTAL UNOCCUPIED	12,182,317	2,338,861	14,521,178
OCCUPIED—			
Pulpwood Berth No. 1, Block 4, Lake Winnipeg East	1,392,657	177,347	1,570,004
TOTAL OCCUPIED	1,392,657	177,347	1,570,004
GRAND TOTAL	13,574,974	2,516,208	16,091,182
PER CENT	84.4%	15.6%	100.0%

*Net roundwood volume: stump height 1′, top diameter 3″.

Air Services, Ltd., as part of the inventory program in the summers of 1952 and 1953.

Base mapping was done by the Provincial Surveys Branch, mapping being done, partly, at a scale of 1:15,840, and partly, at 1:31,680.

Two field sampling parties, each consisting of seven men, were in the field during the summer of 1953, one of these in the vicinity of Berens River, and the other at Norway House. A third sampling party of the same size was centred around Sipiwesk Lake in 1954.

Sample plots of one-fifth acre size, numbering over 3,000, were tallied. These were later combined with plots cruised in the adjoining Northern Mining Forest Section, making a total of 5,386 plots used in the preparation of type volume tables.

A two-man type checking party covered the Upper Berens and Bloodvein working circles in 1954, and a second party of the same size did similar work in the Pikwitonei and Ilford working circles in 1955.

Photo interpretation, forest mapping, and compilation of all working circle volumes were completed by December, 1955, but the summary estimate for the Nelson River Forest Section, as a whole, was delayed until about May, 1956.

Forest Utilization and Potential Yield

Although records have been kept of the Crown timber cut annually in the Northern Forest District from 1930 onward, the figures are not separated for Forest Inventory sections. However, a special study has been made of the cut of the last five years, and it has been possible to make an approximate estimate of the portion cut in the Nelson River Forest Section. To this has been added the estimated cut in that part of the Eastern Forest District which is included in Nelson River. The total average annual cut of the main products—lumber and pulpwood, for the years 1954-55 to 1958-59, inclusive, has been as follows:

Lumber	1,328,000 ft.b.m.
Pulpwood	2,746 cords

Much of the lumber cut has been white spruce taken out in the vicinity of the various Indian Reserves and sawn locally for community purposes, although some has been used by the villages along the Hudson Bay Railway and for mining development. Small quantities of lumber cut in the vicinity of Sipiwesk Lake have been shipped out by rail,

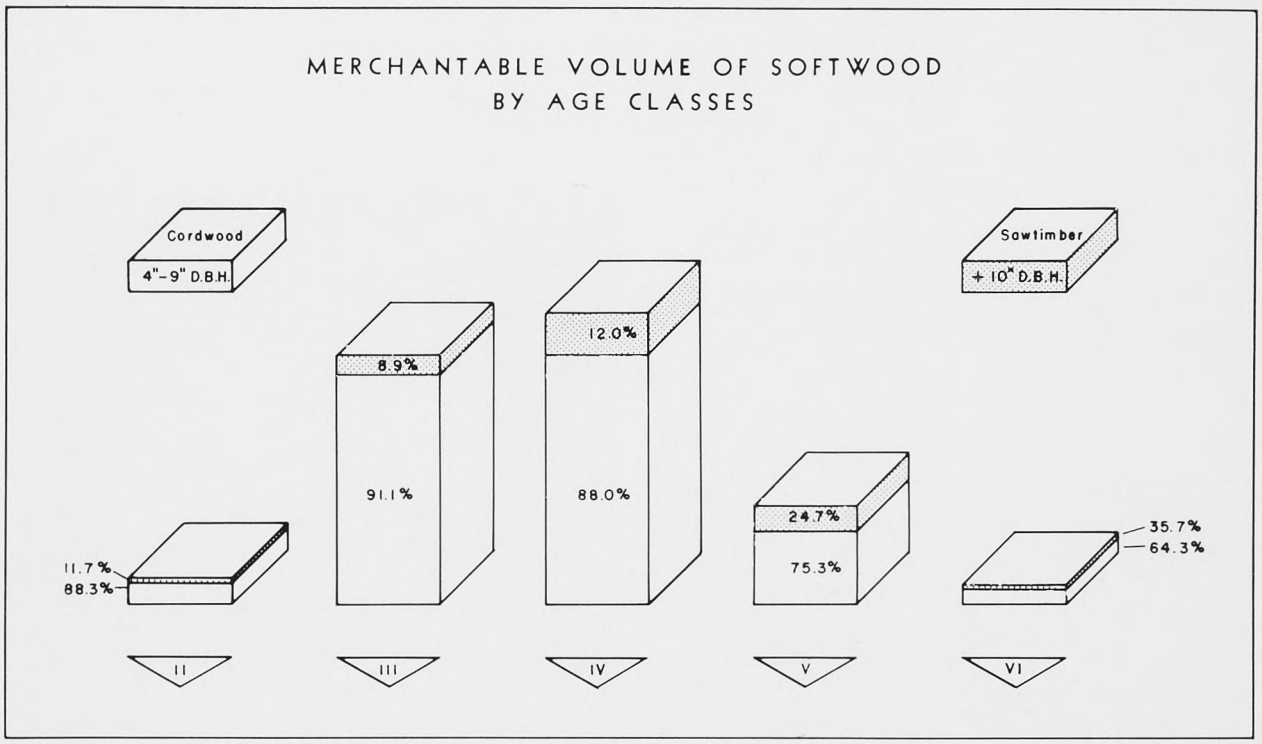


Figure 9.

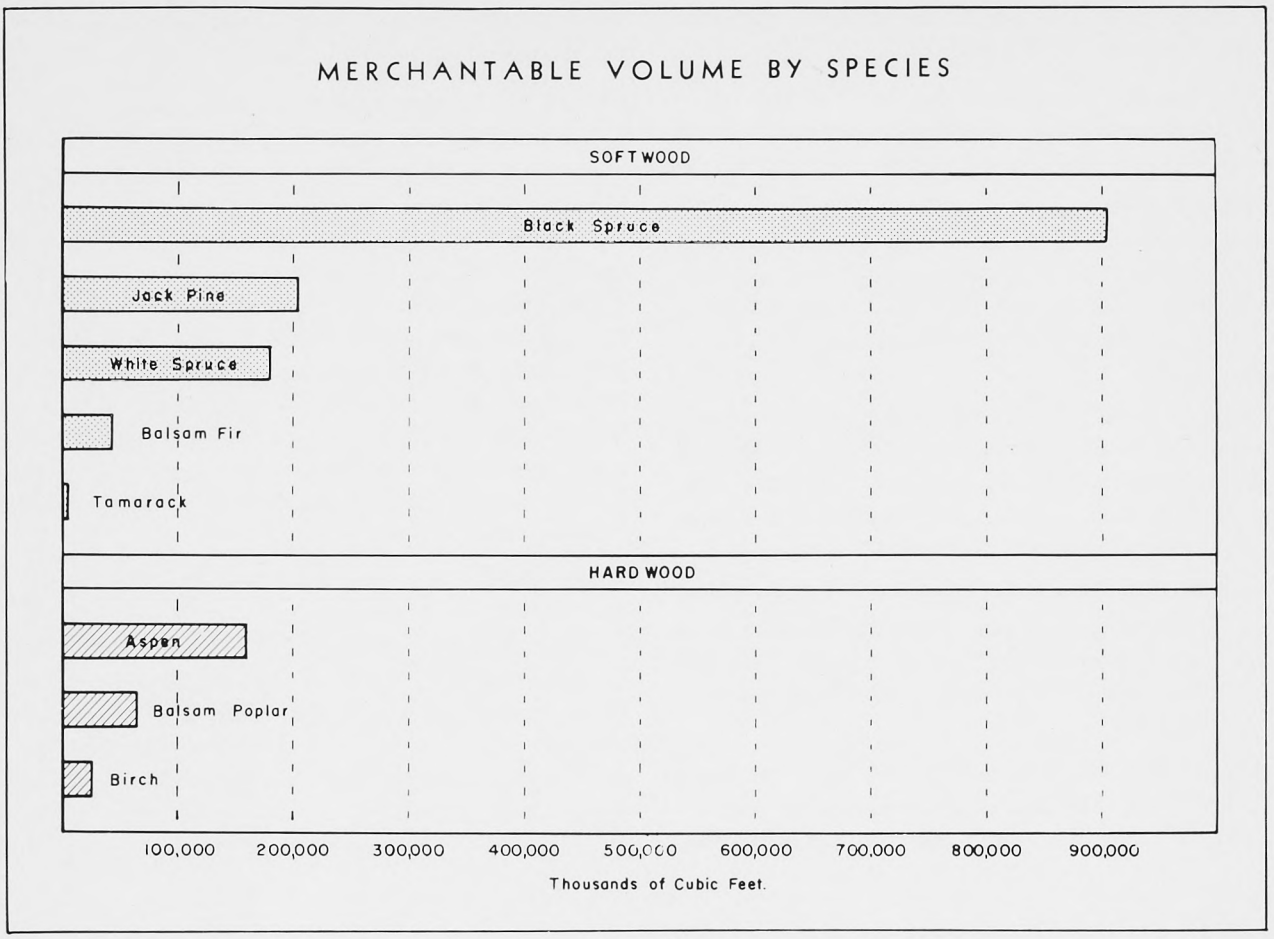


Figure 10.

Table 12

Softwood and Hardwood Volume per Acre Merchantable Area by Subsections—Nelson River Forest Section

SUBSECTION	Volume Per Acre in Cubic Feet		
	Softwood	Hardwood	Total
UNOCCUPIED—			
Lake Winnipeg East	473	125	598
Norway House	515	55	570
Northern	521	101	622
Average for Unoccupied	513	98	611
OCCUPIED—			
Pulpwood Berth No. 1, Block 4, Lake Winnipeg East	940	120	1,060
Average for Occupied	940	120	1,060
AVERAGE	537	100	637

Pulpwood—spruce and balsam fir—Setting Lake.

Table 13

General Stand Volume Table—Nelson River Forest Section
(Data from Final Set of Curves)

HEIGHT CLASS	DENSITY CLASSES (In square feet of basal area per acre at breast height)								
	A 0′ - 20′	B 20′ - 40′	C 40′ - 60′	D 60′ - 80′	E 80′ - 100′	F 100′ - 120′	G 120′ - 140′	H 140′ - 160′	I 160′ - 180′
	VOLUME IN CUNITS PER ACRE (100 cu. ft.)								
4 (30′ - 40′)	1.12	3.69	6.31	8.86	11.52	14.09	.....	.....	.....
5 (40′ - 50′)	1.52	4.92	8.28	11.68	15.07	18.48	21.89	25.26	.....
6 (50′ - 60′)	1.86	5.99	10.25	14.30	18.56	22.81	27.01	31.24	35.49
7 (60′ - 70′)	.....	.....	12.18	17.13	22.23	27.16	32.18	37.23	42.23
8 (70′ - 80′)	.....	.....	14.15	19.90	25.50	31.54	37.26	43.16	48.90
9 (80′ - 90′)	.....	.....	.....	.....	29.10	36.05	42.18	49.20	55.72

Volumes refer to Gross Round Wood Volume to 3″ top and 12″ stump.
Table based on 5,386 one-fifth acre plots measured in the Nelson River and Northern Mining Forest Sections.

and lumber cut recently east of the narrows of Lake Winnipeg in the Bloodvein working circle has been hauled by truck across the lake and southward by road to Winnipeg.

As mentioned above under the heading "Development of the Area," pulpwood has been cut as far north as Sipiwesk and Wintering lakes. Black spruce has been the main species, white spruce being usually reserved for use as saw-timber.

Minor amounts of railway ties, fuelwood, round timber, and poles are also cut. Converting the cut of lumber, pulpwood, and minor forest products, into a common unit of cubic feet, it is found that the average annual depletion from cutting is approximately 6,093 cunits, or 7,168 cords.

The allowable annual cut of softwood and hardwood, on a sustained yield basis, has been calculated approximately, using the method described under "Allowable Cut" in the Appendix to this report.

The result of the calculation is as follows:

Allowable annual cut of softwood	271,499 cunits or 319,410 cords
Allowable annual cut of hardwood	75,486 cunits or 88,807 cords
Allowable annual cut, all species	346,985 cunits or 408,217 cords

This estimate based on the present stand is believed to be conservative, and it can be confidently predicted that with the improvement in fire protection of young growth areas and merchantable timber which is taking place, the sustainable annual yield of the future will be considerably greater. The field survey indicated that in general natural regeneration to coniferous species is satisfactory on burned-over and cut-over areas.

The combination of natural resources and location which exists in this area would appear to make it worthy of consideration as the site of a pulp and paper industry, or an integrated industry producing lumber and pulp. Studies to date indicate that a suitable site for such an industry could be found on Sipiwesk Lake. A mill located on the west shore

Fire-fighters baking bannock at campfire.

of this lake would be close to large volumes of merchantable white and black spruce in the Sipiwesk and Wabowden working circles which could be transported by water. The construction of the Kelsey hydro-electric plant, lower down the Nelson River, will result in stabilizing the water level of Sipiwesk Lake, thus facilitating the towing of log booms. Incidentally, it has been estimated that the total shore line of this lake, including bays and islands, is about 500 miles in length.

There is a very large productive forest area in the surrounding country, most of it already stocked with young growing spruce and jack pine. Hydro-electric power will be available from the Kelsey plant. A short rail line could connect the mill with the Hudson Bay Railway which would be a route for inward shipments of additional wood and outward shipment of the manufactured product. This railway, terminating as it does at the seaport of Churchill, and connecting with a network of Canadian and American railways to the south, will no doubt play an important part in the future development of forest and other industries.

The timber included in the Norway House working circle may be considered separately. While this timber could be driven downstream over the rapids and falls to Sipiwesk Lake, (total drop about 100 feet), it may also be considered as available to a mill on Lake Winnipeg, or at the mouth of the Saskatchewan River—see Forest Inventory Report No. 5. The lakes through which the upper stretches of the Nelson River flow after leaving Lake Winnipeg—Playgreen, Little Playgreen, Kiskittogisu, and Kiskitto, are very little below the level of that lake, and towing upstream would be quite feasible.

M.G.A.S. aircraft refueling at Thicket Portage.

Appendix

SURVEY METHODS

Ground Control

Ground control for aerial photographs was obtained mainly from base lines, township outlines, and subdivision surveys established either before or during the progress of the forest inventory. The distance between control lines varied from one mile in the southern part to as much as 72 miles in the north. In certain cases it was necessary to make traverses of winter roads, lakes, and rivers in order to fill in blanks where cadastral surveys were lacking.

Air Photography

The photographs on which the inventory was based were summer verticals varying in scale from 1:15,840 to 1:36,000, taken mainly in the period 1946 to 1953, inclusive.

Base Mapping

The slotted template lay-down method of base mapping was used. A base map consisted simply of a large sheet of paper showing township grids on which were located the primary and secondary control points of the photographs covering the area.

Field Surveys

The type classification used in this survey was an adaptation of the system developed by S. T. B. Losee of the Abitibi Power and Paper Company. Types were differentiated by species, composition, height, density, site, and subtype, the following breakdown being employed:

(a) *Cover-type*

S : 75-100% conifers by basal area
M : 50- 75% conifers by basal area
N : 25- 50% conifers by basal area
H : 0- 25% conifers by basal area

(b) *Height Class*

1 : Average height of main stand 0-10 feet
2 : Average height of main stand 10-20 feet
3 : Average height of main stand 20-30 feet
Etc.

(c) *Density Class*

A : 0-20 square feet per acre basal area
B : 20-40 square feet per acre basal area
C : 40-60 square feet per acre basal area
Etc.

(d) *Site*

V_1 : Jack pine ridge top
V_2 : Black spruce ridge top
W : Hardwood upper slope
X_1 : Black spruce lower slope
X_2 : Mixed lower slope
Y_1 : Jack pine flat
Y_2 : Poplar flat
Z_1 : Wet flat (black spruce)
Z_2 : Cedar flat

(e) *Sub-type*

–1 : 0- 12% of conifer basal area jack pine
–2 : 13- 37% of conifer basal area jack pine
–3 : 38- 62% of conifer basal area jack pine
–4 : 63- 87% of conifer basal area jack pine
–5 : 88-100% of conifer basal area jack pine

The above subtypes were used in conjunction with all four cover-type symbols—S, M, N, and H, depending on the percentage of jack pine in the coniferous portion of the stand. Additionally, in the S cover-type there might be tamarack subtypes. These were shown by the suffixes L1, L2, L3, L4, and L5, denoting the same percentage of tamarack volume as the first suffixes did for jack pine.

The term type-aggregate has been used as referring to all types in a Forest Section which have common characteristics as to cover-type, height, density, site, and subtype. For example, the symbol "S7EX$_1$-1" denotes a type with 75-100 per cent of the basal area in coniferous species, average height 60-70 feet, basal area per acre 80 to 100 square feet, growing on a lower slope site and mainly black spruce, with a jack pine composition less than 12 per cent of the coniferous basal area.

Sampling was distributed as widely as possible over the total inventory area, the twin objectives being to obtain sufficient data for local tree and type-aggregate volume tables, and to familiarize the photo-interpreters with the varying stand conditions to be found in different localities.

Sampling was by means of one-fifth-acre plots (one-quarter chain wide by eight chains long) established at fixed intervals along cruise lines selected by the party chief. In order to obtain a well-distributed sample of all type-aggregates, the party chiefs were instructed to sample as many type

aggregates as possible from each camp site, and not to take too many plots in one particular type in the same general area. Information recorded on each plot included the cover-type, site class, tally by species of all trees over 3.5 inches D.B.H., and four height-age measurements of representative trees. Notes were also made on the topography, soil and young growth, minor vegetation, and the general condition of the stand. Sufficient form class measurements were made to determine for each species the relationship between form class, diameter, height, and site. Special notes were made on young growth areas.

Forest Maps

The location of all boundary lines between the various forest types was determined almost entirely from examination of the photographs with the aid of a stereoscope.

After photo interpretation, both forestry and planimetric information was transferred from the photos to the base maps by means of either a Sketchmaster or Seelyscope. The areas of the various forest strata were determined either by dot count or by measurement with a planimeter.

Each finished forestry map covers one township at the 1:15,840 scale, or four townships at smaller scales. Ozalid prints of the completed maps were prepared for distribution to district personnel and one master copy of each map was hand-colored for filing, using the standard colors recommended by the Federal Forestry Branch.

Interpretation and Compilation

After field sampling in a given area was completed, the final photo interpretation was made. Since it is on the quality of this work that the accuracy of the inventory largely depends, an effort was made to have the man most familiar with a particular area make the final photo interpretation for that area. Much of the final interpretation was done in the field by the party chiefs and cruisers at a time when stand conditions as they appeared on both the ground and the photos could readily be compared.

The first step in compilation was the transfer of field data to two sets of summary sheets. The height-age and form class data obtained from measurements of sample trees was used to prepare local tree volume tables, while the data on the tally sheets was the basis for the type-aggregate volume tables.

For each Forest Section, separate tree volume tables were prepared for each species, site, and height class. The Dominion Form Class Volume Tables were used in conjunction with the height-age and form class data to prepare the local volume tables. The standard system of harmonizing curves was used.

The next step was the preparation of a general stand volume table showing gross volume per acre, all species combined. Field plot data was segregated by height and density classes regardless of site and cover-type. Using the method of least squares and linear regression a series of straight lines was drawn and later harmonized by the Dwight method. Values read from these lines formed a general stand volume table showing average volume in cunits per acre by height and density classes for the whole Forest Section. See Table No. 13.

The next step was the determination of the proportion of each species in each type-aggregate. This was done by a special method of percentages and curves. Similar methods were used to determine the proportion of the two size classes, four to nine inches D.B.H., and ten inches plus. The percentages as arrived at by harmonizing the curves for each height class were applied to the previously calculated general stand volume table, and the results were tabulated as the final type-aggregate volume table.

Up to this point in compilation, stand age was not considered. However, the large number of height-age measurements obtained in the field made it possible to establish by means of a series of curves, the relationship between site, height, and age for each of the major species on each site. Age classes could then be assigned to all type-aggregates. Thus, when the final volume summaries were made, they were subdivided by cover-type and age class only; height, site, and density being omitted.

Gross volumes of each individual type were first tabulated in cubic feet by numbered types and later compiled in township units by species, cover-type, age class, size class, and land tenure.

In order to express the net rather than the gross volume, a cull factor was established for each species in each Forest Section. This factor was based on a general knowledge of the various species, and notes made by the cruisers regarding defects observed on the sample plots. The cull factor was applied to the gross figures for the Work-

ing Circle and not to the smaller units of type and township. See Table 14.

Table 14

Cull Factor by Species—Nelson River Forest Section

Species	Cull *per cent*
White spruce	5
Black spruce	5
Balsam fir	25
Jack pine	15
Tamarack	10
Aspen	40
Balsam poplar	40
White birch	40

Reports

Fifty-five inventory summaries were compiled for Working Circles or Ranger Districts, each of these units averaging about 1,000 square miles in area. Each summary contains a breakdown of the area and net volume by cover-types and age classes. Subtotals are included for the Crown and patented portions of each unit. Net volumes are expressed in both cunits (100 cu. ft. units) and M ft.b.m. for the ten inch plus diameter group, and in cunits alone for the four to nine inch D.B.H. group. These inventory summaries were totalled by Forest Sections, and a report is being published on the forest resources of each Forest Section.

ROTATION

The length of the rotation for the various species depends on the site, the product to be cut, and, to a lesser extent, the climatic region. Table 15 gives tentative figures for the productive forest area of Manitoba. A range of rotation age is given depending mainly on whether the stand is to be cut for pulpwood or saw-timber.

Table 15

Rotation by Species

Species	*years*
White spruce	80 - 120
Black spruce	80 - 140
Balsam fir	60 - 80
Jack pine	60 - 90
Tamarack	70 - 100
Cedar	100 - 200
Aspen poplar	50 - 70
Balsam poplar	50 - 70
White birch	60 - 80

ALLOWABLE CUT

A determination of the allowable annual depletion by cutting, fire, etc., is necessary in order that the forest may be kept on a sustained yield basis. The compiled inventory data presents volume by cover-type, age class, and species while area is presented by age class and cover-type only. The method of calculation most suitable to the available data is by a volumetric formula.

The simplest formula for finding the annual yield, commonly known as the Von Mantel formula, is as follows:

$$\text{Annual Yield} = \frac{\text{Growing Stock}}{\text{Half the number of years in rotation}}$$

For general inventory purposes this formula has been used as the basis for calculation of the allowable cut by Working Circles, each species being calculated separately according to its average rotation age. A deduction of 20 per cent has been made to allow for contingencies such as loss from fire, windfall, insects, and disease.

In those areas which have established Working Plans such as the Southeastern Forest Section, the Duck Mountain Forest Reserve, Pulpwood Berth No. 1, and certain portions of the Lowlands South Forest Section, various alternative methods have been used in arriving at the Allowable Cut. It is usual in these cases to secure a more accurate estimate of the Allowable Cut by methods which take into account any unevenness in age class distribution.

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Common and Botanical Names of Tree Species Included in Timber Estimates

CONIFERS

White Spruce — *Picea glauca (Moench) Voss*
Black Spruce — *Picea mariana (Mill) BSP.*
Balsam fir — *Abies balsamea (L.) Mill*
Jack pine — *Pinus banksiana Lamb.*
Tamarack — *Larix laricina (Du Roi) K. Koch*

HARDWOODS

Aspen poplar — *Populus tremuloides Michx*
Balsam poplar — *Populus balsamifera L.*
White birch — *Betula papyrifera Marsh.*

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DEPARTMENT OF MINES AND NATURAL RESOURCES

PROVINCE OF MANITOBA

FOREST SERVICE

This is one of a series of reports summarizing the results of a ground and aerial survey of the Forest Resources of Manitoba, recently completed. The area and volume figures in this new series replace earlier figures which were published by the Dominion Forest Service in 1934, in Bulletin 85, "The Forests of Manitoba".

Additional copies may be obtained from the office of the Provincial Forester, 469 Broadway Ave., Winnipeg 1.

Hon. C. H. Witney,
Minister

J. G. Cowan,
Deputy Minister